

Improving epidemic control: lessons from the 1987 toxic mussels affair

Tom Kosatsky, MD, MPH

Although explosive outbreaks of serious disease secondary to the consumption of contaminated food are rare, their control requires effective and rapid action. Despite the pressure to act quickly, decision-makers are often hampered by the absence of firm evidence of causality. The stakes are high: the risk of unnecessary disease if response is delayed and economic hardship if a product is erroneously incriminated.

Because public health emergencies are uncommon, a review of each situation helps to prepare for the next emergency. An analysis of the public health response in the 1987 toxic mussels affair, a disease outbreak that was characterized by some as a delayed response on the part of public health authorities (*The Gazette*, Montreal, Dec. 11, 1987: 1), can help to identify opportunities for disease prevention.

In late 1987 cases of gastrointestinal and neurologic illness occurring within hours after eating mussels were reported across Canada.¹ Overall, 19 people were admitted to hospital, of whom 3 died. For many of those affected the only symptoms were nausea, abdominal cramps and diarrhea. Common neurologic manifestations included disorientation, confusion and loss of short-term memory. Among some victims, particularly men over 60 years of age, these manifestations progressed to mutism, seizures and coma. For some survivors the short-term memory deficits have been irreversible.² This complex of central nervous system dysfunction after shellfish ingestion had not been described previously.²

Recognition and investigation of the epidemic involved physicians as well as public health, food quality and fisheries officials from across Canada. Measures to control the epidemic were effective: within a few days after suspect mussels from Prince

Edward Island (PEI) were withdrawn from the market and the federal government issued a public health alert, no more new cases were reported.

Astute clinicians in several centres recognized early the unusual nature and public health significance of their patients' illness. During mid to late November 1987 various government agencies were contacted by practitioners and hospitals. On Nov. 22, physicians in Moncton, NB, telephoned the Department of Fisheries and Oceans (DFO) about two cases, which led to the recovery of leftover mussels and the subsequent testing of mussel extracts in laboratory mice.³ Medical residents and their attending physician at Montreal's Royal Victoria Hospital relayed their suspicions of a link between mussels and the severe illness of two intensive-care-unit patients in a Nov. 24 telephone call to the director of a Montreal community health department (*The Gazette*, Montreal, Dec. 3, 1987: 1).

By Nov. 27 the Department of National Health and Welfare (DNHW) had been notified of the cases in Moncton and Montreal and of two additional cases in PEI.³ On the same date DNHW scientists demonstrated that suspect mussels caused a bizarre lethal reaction in laboratory mice. Investigations by Montreal food inspectors and by DFO officials indicated that the suspect mussels were most likely harvested in PEI. On Nov. 29 the DFO suspended the distribution of fresh PEI mussels, and on Dec. 1 the DNHW issued a public health alert. By Dec. 18 an interdisciplinary analytic working group had identified domoic acid as the toxin in the PEI mussels.³

During December 1987 public health officials across Canada cooperated in identifying people who had become ill after eating mussels; 107 people met

Reprint requests to: Dr. Tom Kosatsky, Département de Santé communautaire, Hôpital Maisonneuve-Rosemont, Ste. 470, 5565 Sherbrooke St. E, Montreal, PQ H1N 1A2

the case definition (acute gastrointestinal or neurologic disease after ingestion of PEI mussels). They had become ill over a 1-month period beginning Nov. 4. The frequency of cases was greatest around weekends, most people becoming ill before and around the implementation of the control measures.¹

Quebec accounted for 71 (66%) of the cases in Canada. Fig. 1 shows the distribution of cases in Quebec by the date mussels were reportedly last eaten. Onset of illness occurred up to 2 days after ingestion and admission to hospital up to 5 days after.

In Table 1, I have estimated the effects that earlier intervention might have had on the course of the epidemic. Seven people from Quebec ate toxic mussels after the Nov. 29 embargo on shipments from PEI; two of them did so after the Dec. 1 public health alert. No matter how early the public health alert might have been issued, I assume that the two people who purchased mussels before the alert but

ate them afterward would have become ill. Five fewer Quebecers might have had mussel-related illness had the alert been issued on the same day as the embargo. Had such action been taken 2 days earlier, when DNHW officials were aware of at least six cases across the country (and had demonstrated toxic effects in laboratory mice) 26 Quebec cases might have been averted. Had the four cases in Moncton and Montreal triggered a national response on Nov. 24, illness might have been averted in 42 people in Quebec.

These estimates represent an upper limit for preventing illness in Quebec. However, in the context of an explosive outbreak of unexpected food-borne disease, a few days' delay in the implementation of control measures can result in numerous cases. How can we translate this lesson from the mussels affair into strategies for earlier action in the next emergency?

- Prompt and effective reporting by suspicious

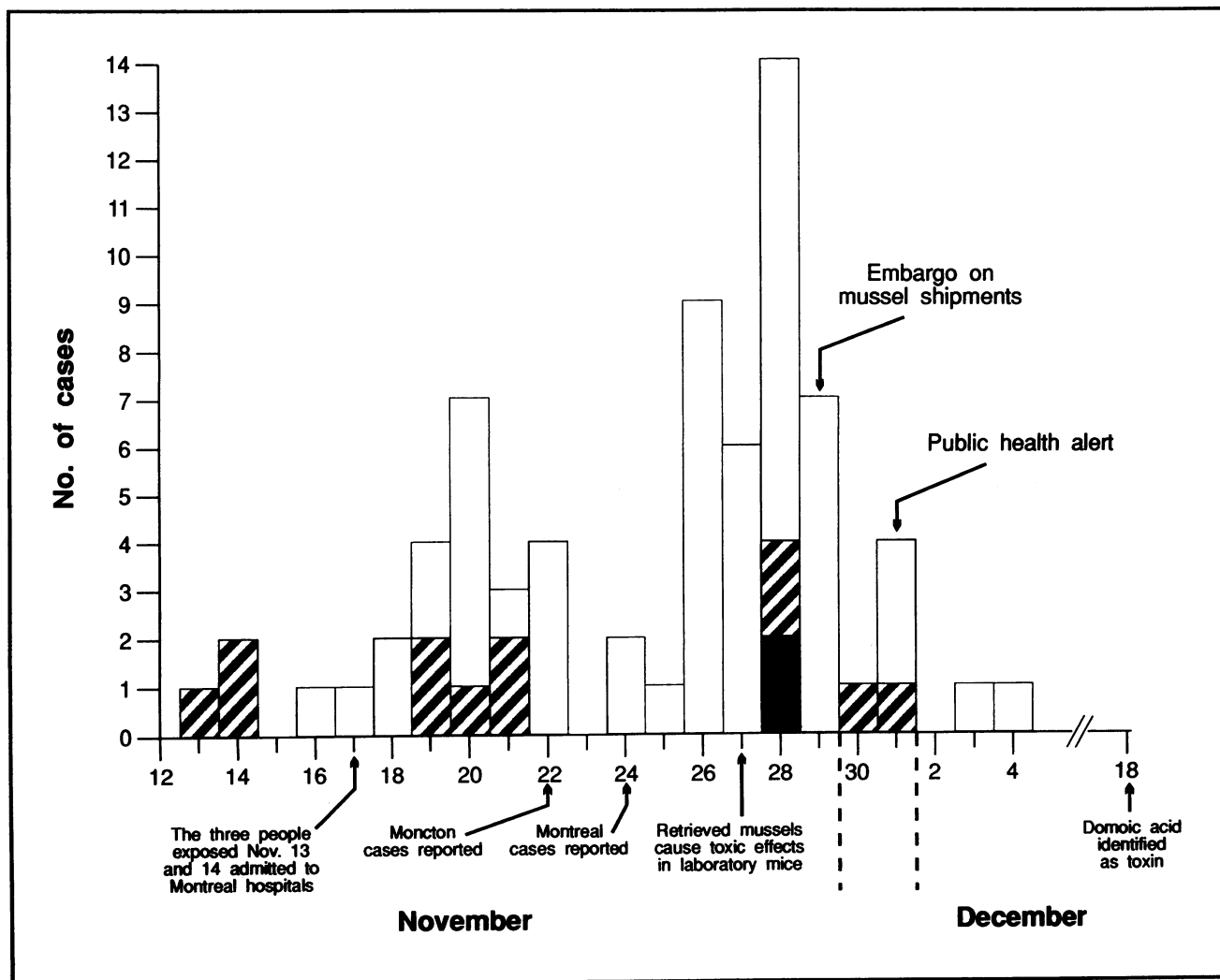


Fig. 1: Distribution of cases of mussel-related illness (white portions of bars), hospital admissions (hatched portions) and death (black portion) in Quebec by date of mussel consumption, in November and December 1987. Broken rules represent phased implementation of control measures. (Information from case registry established by the Bureau régional des maladies infectieuses, Montreal.)

clinicians is crucial to the timely recognition of epidemics. There were three patients with mussel-related illness in Montreal intensive care units by Nov. 17 (albeit in three different hospitals). Had clinicians reported them to public health authorities, earlier investigation might have led to earlier implementation of control measures. Public health authorities at all levels must encourage clinicians to consider unusual illness in their patients to be sentinel of a larger public health problem and to relay their suspicions.

- Sentinel reports indicating a risk of mass illness must be transmitted promptly throughout the public health network. Had the initial Moncton and Montreal reports triggered calls from Ottawa to provincial and local health departments and had these departments begun earlier to query hospitals and clinicians about cases of illness, the size and breadth of the epidemic would have been ascertained more quickly.

- Public health authorities must be ready to take early and definitive action on the basis of emerging epidemiologic and laboratory evidence, even if that evidence is not complete. In 1987 initial laboratory evidence, although supporting the conclusion that PEI mussels were toxic, was somewhat confusing; the different reaction in mice injected with mussel extracts from that associated with previously recognized marine toxins should, I believe, have strengthened the weight given epidemiologic evidence of a new and serious intoxication. In retrospect I believe that the DNHW decision-makers should have issued a public warning on Nov. 27, when they became aware of cases across Canada, and

certainly on Nov. 29, when their colleagues at the DFO judged the combined epidemiologic and toxicologic evidence sufficient to place the embargo on mussel shipments.

Although this analysis suggests that more rapid preventive action could have been taken, it also demonstrates the effectiveness of a national epidemic control strategy. A nationwide outbreak of an unrecognized illness is a rare event. Because most of the patients with the more striking neurologic manifestations were over 60 years of age¹ clinicians might have missed or discounted the connection to mussel consumption. Mussel-associated intoxication has long been recognized in Canada.⁴ However, paralytic shellfish poisoning, the form commonly seen, has clinical and toxicologic characteristics quite different from those observed during the 1987 outbreak. The transfer of information between and within government departments could not have been instantaneous. Federal authorities balanced the danger to the health of consumers against concerns that an unsubstantiated embargo and public warning would have damaged the mussel industry. Public health intervention might at best have been initiated only a few days earlier.

Control of epidemics involves various actors: practitioners, patients and their families, public health professionals, food safety inspectors, laboratory scientists, members of the media and political decision-makers. Epidemics call forth powerful influences. In the mussels outbreak the public and the media were involved only after control measures were put into place; the 1992 programs for mass-vaccination against meningococcal disease demonstrat-

Table 1: Estimated number of cases of mussel-related illness, hospital admission and death in Quebec that would have been prevented if both control measures (mussels embargo and public health alert) had been implemented on the basis of each event

Event	No. of cases prevented*		
	Total†	Hospital admission‡	Death
Three hospital admissions in Montreal (Nov. 17)§	64	11	2
Notification of two Quebec cases (Nov. 24) (after notification 2 days earlier of two New Brunswick cases)	42	6	2
Case reports from Prince Edward Island plus demonstration of mussel toxicity (Nov. 27)	26	6	2
Decision to embargo (Nov. 29)	5	2	0

*Based on the numbers of Quebec cases that occurred both before and after the Dec. 1 public health alert (see Fig. 1); they should be considered an upper limit.

†Includes cases of illness, hospital admission and death.

‡Includes cases of death.

§Although notification of the three hospital admissions to Montreal public health authorities would not have led to immediate implementation of control measures, it might have advanced the process of epidemic recognition and investigation.

ed the explosive potential of the media and of public opinion on the nature and timing of measures to control what was perceived as an outbreak.⁵

The meningococcal crisis, like the mussels outbreak, shows the importance of reliable disease surveillance, of central coordination and leadership, and of decision making that both acknowledges and reduces uncertainty. An open review of how and when policy was made in that crisis or in any disease outbreak may provide lessons for next time. One possible format for such review would be to juxtapose the dates of disease onset with actual and hypothetical epidemic control measures.

I thank Danielle Fortin, Manon Girard and Robert Palmer for their help in preparing the manuscript, Robert Remis and Lucie Bédard, Bureau régional des maladies infec-

tieuses, Montreal, and John Hoey, Department of Epidemiology and Biostatistics, McGill University, Montreal, for their comments. The opinions expressed in the article are those of the author.

References

1. Perl TM, Bédard L, Kosatsky T et al: An outbreak of toxic encephalopathy caused by eating mussels contaminated with domoic acid. *N Engl J Med* 1990; 322: 1775-1780
2. Teitelbaum JS, Zatorre RJ, Carpenter S et al: Neurologic sequelae of domoic acid intoxication due to the ingestion of contaminated mussels. *Ibid*: 1781-1787
3. Chronology of the toxic mussels outbreak. *Can Dis Wkly Rep* 1990; 16 (suppl 1E): 3-4
4. Shellfish and fish poisoning in Canada, 1972-1983. *Can Dis Wkly Rep* 1984; 10: 21-24
5. Gray C: Meningococcal disease: Was Ottawa's mass-vaccination program necessary? *Can Med Assoc J* 1992; 146: 1033, 1036-1037

Conferences

continued from page 1768

Mar. 18-23, 1993: Association for Applied Psychophysiology and Biofeedback 24th Annual Meeting
Los Angeles

Joette Cross, director of meetings, Association for Applied Psychophysiology and Biofeedback, Ste. 304, 10200 W 44th Ave., Wheat Ridge, CO 80033; tel (303) 422-8436, fax (303) 422-8894

Mar. 19-21, 1993: Canadian-Trinidad and Tobago Medical Convention (sponsored by the Trinidad and Tobago Medical Association)

Trinidad and Tobago
Medical Staff Office, Queensway General Hospital, 150 Sherway Dr., Etobicoke, ON M9C 1A5; tel (416) 253-2938, fax (416) 253-0111

Mar. 26, 1993: Nutrition and Women's Health — New Perspectives

Toronto
Vitamin Information Program Symposium, Hoffmann-La Roche Limited, 2455 Meadowpine Blvd., Mississauga, ON L5N 6L7; tel (416) 542-5610

Mar. 29-31, 1993: Excellence in Medical and Scientific Writing

Toronto
McLuhan and Davies Communications, Inc., 167 Carlton St., Toronto, ON M5A 2K3; tel (416) 967-7481, fax (416) 967-0646

Apr. 4-8, 1993: 13th World Congress on Occupational Safety and Health
New Delhi, India

Official languages: English, French, Spanish, German and Japanese

Congress Secretariat, 13th World Congress on Occupational Safety and Health, National Safety Council, PO Box 26754, CLI Building — Sion, Bombay 400 022, India; tel 011-91-22-4073285, fax 011-91-22-4075937

Apr. 5-9, 1993: 4th International Meeting on Trace Elements in Medicine and Biology — Trace Elements and Free Radicals in Oxidative Diseases (organized by the Society for Free Radical Research and the Société francophone d'étude et de recherche sur les éléments trace essentiels)

Chamonix, France

Official language: English. Simultaneous translation languages: French-English.

Prof. Alain Favier or Mme. Arlette Alcaraz, Laboratoire de Biochimie C, Hôpital A. Michallon, BP 217X, 38043 Grenoble Cédex 09, France; tel 011-33-76-76-54-07, fax 011-33-76-42-66-44

Apr. 18, 1993: 5th Annual Symposium on Treatment of Headaches and Facial Pain

New York
Dr. Alexander Mauskop, Director, New York Headache Center, 301 E 66th St., New York, NY 10021; tel (212) 794-3550

Apr. 18-21, 1993: Medical Excellence in Africa — 57th Biennial Congress of the Medical Association of South Africa (MASA)

Sun City, South Africa

MASA congress convenor, PO Box 20272, Alkantrant 0005, Republic of South Africa; tel 011-27-012-329-1359, fax 011-27-012-329-1345

continued on page 1786